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Virginia Calibration Methods

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Virginia Calibration Method - 1

Equipment Checked: **L. A. Abrasion Machine**

Purpose:

This method provides instructions for checking the critical dimensions and general operating conditions of the L. A. Abrasion Machine and the mass of the spheres used as test charges.

Inspection Equipment Required:

1. Steel rule readable to 1 mm
2. Stopwatch readable to 0.1 sec.
3. Balance with a 5 kg capacity, readable to 1g.

Tolerance:

The L. A. machine shall meet the dimensional tolerances specified in the AASHTO T-96 and shall be in good operating condition. The steel spheres used to charge the L. A. machine shall meet the mass tolerances specified in T-96.

Procedure:

L. A. Machine

1. Measure and record the inside diameter of the drum at the left and right edges to the nearest 1 mm.
2. Measure and record the width and height of the opening to the nearest 1 mm.
3. Measure and record the wall thickness at the left and right edge to the nearest 1 mm.
4. Determine if the cylinder is horizontal by using a steel ball to check right to left roll.
5. Measure and record the shelf width inside the drum t the nearest 1 mm.
6. Measure and record the distance from the shelf to the opening in the direction of rotation.
7. Using the stopwatch, determine the RPM to the nearest whole number over a 5 minute period. Record the RPM.
8. Check that the number of revolutions is 500 by looking at the counter on the machine.

Steel Spheres

1. Determine and record the mass of each sphere to the nearest 1 g.
2. Determine and record the mass of the collective charge(s) to the nearest 1 g.

Note: Critical dimensions not subject to abrasion must be checked when the machine is first put in service and need not be checked unless there is reason to suspect changes.

Virginia Calibration Method - 2

Equipment Checked: **Gas Flow Meter**

Purpose:

This method provides instructions for calibrating the gas flow meter.

Inspection Equipment Required:

1. Flat bottom pan (approximately 12" in diameter and approx. 4½" deep) capable of holding approximately 4,000 ml water.
2. Stop watch
3. A beaker or jar (graduated in ml's) capable of holding 1,000 or more ml of water.

Tolerance:

Procedure:

1. Pour approximately 3,000 ml of water into pan.
2. Fill beaker or jar full with water.
3. Holding hand or stopper over mouth of beaker or jar, set beaker or jar upside down in pan of water. Remove hand or stopper from under jar.
4. Take reading of water level in beaker or jar. This will be reading A.
5. Turn on CO_2 and adjust flow meter mercury to approximately eight (8) mm on flow meter scale.
6. Insert CO_2 tubing under mouth of beaker or jar and time for one (1) minute.
7. After one (1) minute remove CO_2 tube from under mouth of beaker or jar and record water level in jar. This will be reading B.
8. Subtract reading in step No. 4 from reading in step No. 7 = [B – A]. The difference will be the amount of CO_2 you are getting per minute.
9. A higher or lower amount of CO_2 can be obtained by using a different setting of mercury or moving to another size hole on the stopper of the flow meter. Both may be necessary.
10. An average of three (3) tests should be used to determine the final setting and stopper hole size to use.

Virginia Calibration Method - 3

Equipment Checked: **Sieves**

Purpose:

This method provides instruction for checking the physical condition of laboratory tests sieves ranging in size from 75 mm.

Inspection Equipment Required:

1. An eyepiece with a scale readable to 0.001 mm (for use when checking sieves finer than 2.36 mm (No. 8).
2. A caliper readable to 0.01 mm. (Use for 2.36 mm [No. 8] and coarser.)
3. A half-tone screen determiner may be used for checking sieves finer than 425µm.

Tolerance:

Sieves shall meet the physical requirements specified in AASHTO M92.

Procedure:

1. Select and adequate number of individual sieve openings (3 or 4) along a 45° line. Measure and record the sieve openings to verify that the size opening indicated on the label is correct, of if the half-tone determiner is to be used the following procedure is employed. Place the screen determiner on the sieve and rotate slowly until a "star" will form on the center line of the screen to indicate the lines per inch measurement of the subject screen.
2. Repeat step 1, rotating the sieve 90°.
3. Inspect the general condition of the sieve. Check the frame and solder joints for cracks or holes (check for pin holes in the finer sieves).
4. Make sure the sieve has an appropriate label.
5. Check for tightness of the wires on each individual sieve.

Virginia Calibration Method - 4

Equipment Checked: **Drying Oven**

Purpose:

This method provides instructions for verifying the dial settings on general-purpose drying ovens.

Inspection Equipment Required:

1. A calibrated thermometer graduated in 1.0 C increments, having a range including the temperature being checked.
2. A brass thermometer well to retain heat while the oven door is open. This is essential for a constant temperature reading.
3. A clothes pin to hold the thermometer in such a manner as to enable the operator to read the scale easily from outside or inside the oven.

Tolerance:

Drying ovens shall be capable of maintaining a constant temperature range listed in the appropriate test methods.

Procedure:

1. Place the thermometer inside the brass well with the clothes pin attached to the thermometer. Position the thermometer on the shelf where the samples are normally dried.
2. Take the first reading at least 1 hour after closing the oven (oven should remain undisturbed).
3. Take as many readings as necessary to determine if the temperature range is within the specified tolerance. If the first reading agrees with the temperature setting and past readings, it will suffice.
4. Adjust the temperature of the oven if an observed temperature reading is outside the tolerance specified (allow at least 1/2 hour for the temperature to stabilize between each adjustment).

Virginia Calibration Method - 5

Equipment Checked: **Penetration Apparatus (AASHTO T49) (ASTM D5)**

Purpose:

This method provides instructions for checking the equipment used to perform the penetration test.

Inspection Equipment Required:

1. Balance, readable to 0.01 g.
2. Microscope or eyepiece, 10X.
3. Metal block, 10.0 mm high. Metal block, 25.4 mm (1 in.) high.
4. Support block, 3 – 3.5 in. high.
5. Ruler, readable to 1 mm.
6. Calibrated stopwatch, readable to 0.1 sec.

Tolerance:

The equipment shall meet the tolerances specified in test method T49 and D5.

Procedure:

1. Remove the spindle, 50 and 100 g. weights from the penetrometer. Record the weight of each to the nearest 0.01 g.
2. Weigh each needle to the nearest 0.01 g. Visually examine each needle with a microscope or eyepiece. Each needle should be straight and free of burrs. The base of each needle should be flat. Record results.
3. If an automatic timing mechanism is used on the penetrometer, start the calibrated stopwatch when the plunger is released and stop the calibrated stopwatch when the plunger stops, record the time indicated on the calibrated stopwatch to the nearest 0.1 sec. If a manual device is used to release the plunger, check the accuracy of the timing device used over a 60 sec. interval. Record the elapsed time to the nearest 0.1 sec.
4. Place the support block on the base of the penetrometer. Place the 10 mm block on the support block. Adjust the needle height so that its tip just touches the top of the 10 mm block. Remove the 10 mm block and release the needle to the support block. Adjust the instrument to measure the distance moved. Repeat step No. 4 using the 25.4 mm (1 in.) block. Determine dial accuracy by comparing readings with the height of the blocks. Record results.
5. Using the ruler, measure and record the distance from the perforated shelf to the bottom of the water bath.
   Measure and record the distance from the perforated shelf to the surface of the water.
   Measure and record the distance the thermometer is immersed in the water.
6. Read and record the temperature of the water in the bath to the nearest 0.1° F (0.05° C).

Virginia Calibration Method - 6

Equipment Checked: **Thin–Film Oven (T179) (D1754)**

Purpose:

This method provides instructions for checking the critical components of a thin-film oven.

Inspection Equipment Required:

1. Ruler, readable to 1/8 inch
2. Timer, readable to 0.1 sec.

Tolerance:

The equipment shall meet the tolerances specified in test method T179 and D1754.

Procedure:

1. Open the oven door. Measure and record the distance from the shelf to the bottom of the thermometer bulb. Measure and record two distances along the shelf radius: From the shelf's outer edge to the thermometer and from the thermometer to the shelf's center.
2. Perform the test according to T179 or D1754. After placing the test samples in the oven, record the time needed for the oven to recover to test temperature.
3. Record the oven temperature at half-hour intervals until the test is complete.
4. Record the number of shelf rotations in one minute.

Virginia Calibration Method - 7

Equipment Checked: **Ductility Apparatus**

Purpose:

This method provides instructions for checking the equipment used to perform the ductility test.

Inspection Equipment Required:

1. Ruler, readable to 1 mm.
2. Timer, readable to 0.1 sec.
3. Thermometer, calibrated and readable to 0.5°C (1.0°F)

Tolerance:

The equipment shall meet the tolerances specified in the applicable test method.

Procedure:

1. Assemble a mold. Measure the thickness and the width at the minimum cross-section to 1 mm. Record results
2. Fill the ductility machine with water.
   Adjust temperature of water.
   Attach the clips of a mold to the pins or hooks of the testing machine.
   Measure, to nearest 1 mm, the distance from the top of the mold to the water level.
   Measure, to the nearest 1 mm, the distance from the bottom of the testing machine to the bottom of the mold.
3. Start the ductility machine. Measure and record the distance through which the clips have been pulled to produce rupture.
4. Measure and record the depth of the water in the bath (if used).
5. Read and record the temperature of the water in the bath.

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Virginia Calibration Method - 8

Equipment Checked: **Vacuum System (Manometer)**

Purpose:

This procedure provides instructions for checking and calibrating the equipment used in AASHTO Test Method T202.

Equipment Required:

1. Absolute Pressure Gauge
2. Water Vapor Trap
3. Hoses, Connectors, Tools Misc.

Tolerance:

Equipment shall be capable of applying vacuum specified in the applicable test method ±0.5 mm of the desired level up to and including 300 mm of mercury. Glass tubing if 6.35 mm (1/4 in.) inside diameter Manometer having 1 mm gradations.

Procedure:

1. Connect the gauge to the system with the trap in line between the system and the gauge.
2. Make sure all connections are air-tight.
3. Open number of lines normally used in testing and read and record the pressure indicated on the gauge.

Virginia Calibration Method -9

Equipment Checked: **Timers**

Purpose:

This procedure provides instructions for checking the accuracy of timing devices.

Inspection Equipment Required:

1. Timer, readable to 0.1 sec., having a verified accuracy within the tolerance listed in above test methods.

Tolerance:

Timers shall meet the accuracy requirements specified in the applicable test methods listed above.

Procedure:

1. Hold the calibrated timer in one hand and the timer to be checked in the opposite hand.
2. Start the timers simultaneously by pressing the "start" buttons at the same time.
3. Allow the timers to run for at least 15 min. the stop the timers simultaneously. Record the time indicated by both timers.
4. Record the difference between the two timers. Calculate and record the percent accuracy.

$$\% \text{ accuracy} = \frac{(A-B)}{B} \times 100$$

A = Reading on lab timer (Sec)
B = Reading on standard timer (Sec)

Virginia Calibration Method - 10

Equipment Checked: **Manual Hammer**

Purpose:

This method provides instructions for checking the critical dimensions of the proctor hammer.

Inspection Equipment Required:

1. Calipers readable to 0.001 inch.
2. Tape measure readable to 1/16 inch.
3. Balance, capacity 5 kg. Readable to 1 g.

Tolerance:

The equipment shall meet the dimensional tolerances specified in applicable test method.

Procedure:

1. Use calipers to measure and record to the nearest .001 inch, the diameter of the rammer face determined by taking two readings 90° apart using the calipers.
2. Pull up the handle, measure and record the drop height of the hammer to the nearest .1 inch. Determine this height inside the guide-sleeve using the tape measure.
3. Remove the hammer from the guide-sleeve. Determine and record its mass to the nearest 1 g.
4. Measure and record to the nearest .001 inch, the diameters of the vent holes near both ends of the hammer.

Virginia Calibration Method - 11

Equipment Checked: **Molds**

Purpose:

This procedure provides instruction for checking the critical dimensions of 100 mm, 150 mm, 200 mm and 300 mm molds used in material testing.

Inspection Equipment Required:

1. Calipers, capable of measuring the height and inside diameter of the molds and readable to .025 mm.

Tolerance:

The height and diameter of the molds checked shall meet the dimensional tolerances specified in the applicable test method, for the molds shall be used.

Procedure:

1. Measure and record the inside diameter of the mold to the nearest .025 mm. Rotate the mold 90° (¼ turn) and measure and record the inside diameter again.
2. Turn the mold over and repeat Step 1.
3. Measure and record the height of the mold to the nearest .025 mm. Rotate the mold 90° (¼ turn) and measure and record height again.

Virginia Calibration Method - 12

Equipment Checked: **Fluid Baths**

Purpose:

This method provides instructions for checking the critical dimensions, temperature, and operation of fluid baths.

Inspection Equipment Required:

1. Ruler readable to 1 mm
2. Thermometer readable to 0.5º C or smaller increments if specified in applicable test procedure

Tolerance:

Fluid baths shall contain the fluid specified in the applicable test procedures for which it is to be used and shall meet any operational or feature requirements specified.

Procedure:

*****1. Measure and record the critical dimensions, to the accuracy of the ruler, of the bath container {height, width, shelf height (if present) or any other specified dimension}. Check to ensure that these dimensions are within specifications relating to the tests for which the bath is to be used.

2. Ensure that the proper fluid is used to fill bath. Measure and record the fluid level(s) {height from top or bottom of bath if specified and/or height above shelf (if present)}.
3. Measure and record the bath temperature at several random or critical locations, to the accuracy of the thermometer, at all required operating ranges. Check to ensure that the dial settings correspond with the measured temperature.
4. Check to ensure that any and all circulation pumps or other devices are functioning properly.
5. Ensure that any specified special features are present and functioning properly.

***** This step needs to be performed upon initial setup and is not required unless there is visible damage to the equipment or other reason to expect a problem.

Virginia Calibration Method - 13

Equipment Checked: **Auto Compactor**

Purpose:

This method provides instructions for calibrating the auto compactor used in preparing molds of soil for Optimum Moisture/Maximum Density and CBR tests.

Inspection Equipment Required:

1. Balance readable to + 0.01 lb. (.001 Kg)
2. Caliper readable to + 0.001 in.
3. Ruler or Tape Measure readable to + 0.01 in. (or 1/16 in.)

Tolerance:

The auto compactor shall meet the requirements of AASHTO T 99 2.2.2 or T 180 2.2.2 as applicable and the requirements listed below.

Procedure:

1. Remove the rammer assembly and weigh that part which free falls with the impact face. Ensure that the weight complies with the applicable AASHTO specification, or the weight required to duplicate manual hammer results as applicable.
2. Use the caliper to measure the diameter or the impact face to the nearest 0.001 inch, rotate 90 degrees and measure again. Calculate the average diameter and ensure that it complies with the applicable AASHTO specification.
3. Reassemble the compactor and use the ruler or tape measure to determine the free fall drop height. Ensure that this height complies with the applicable AASHTO specification.

Virginia Calibration Method - 14

Equipment Checked: **Mechanical Splitters**

Purpose:

This method provides instructions for checking the working °C condition and critical dimensions of mechanical splitters used for various materials.

Inspection Equipment Required:

1. Steel rule readable to 1 mm and/or Calipers readable to 0.1 mm

Tolerance:

The mechanical splitters shall meet the requirements of AASHTO T 248 4.1 and the requirements detailed below.

Procedure:

Splitters for Coarse Aggregate

1. Check the splitter for cleanliness and proper working condition. (Note condition of hopper to ensure that it is not bowed or otherwise damaged.)
2. Count the number of chutes. Verify that this number is even, a minimum of eight (8), and that the chutes discharge alternately to each side of the splitter.
3. Use the ruler or caliper to measure the openings between each chute to the nearest 1 mm. Verify that each opening is the same size + 1 mm and at least 1.5 times larger than the largest top size aggregate split.

Splitters for Fine Aggregate

1. Check the splitter for cleanliness and proper working condition. (Note condition of hopper to ensure that it is not bowed or otherwise damaged.)
2. Count the number of chutes. Verify that this number is even, a minimum of twelve (12), and that the chutes discharge alternately to each side of the splitter.
3. Use the caliper to measure the openings between each chute to the nearest 0.1 mm. Verify that each opening is the same size + 0.2 mm and at least 1.5 times larger than the largest top size aggregate split (12.5 mm is recommended).
4. Check to ensure that the splitter is equipped with a hopper or straight edged pan which has a width equal to or slightly less than the overall width of the assembly of chutes, by which the sample may be fed at a controlled rate to the chutes.

Virginia Calibration Method - 15

Equipment Checked: **Saybolt Furol Viscosity @77°F and 122°F**

Purpose:

This method provides instructions for checking to see that the equipment conforms to the requirements of AASHTO T59 and T72 Test Methods.

Inspection Equipment Required:

1. Metric ruler readable to 0.1 mm
2. Viscosity Oil Standard conforming to Table A2.1, AASHTO T72

Frequency:

36 Months

Tolerance:

The equipment shall meet the dimensions and requirements specified in AASHTO T59 and T72 Test Methods.

Procedure:

1. Inspect and record the dimensions and requirements of the apparatus described in AASHTO T72 Test Method for Saybolt Furol Viscosity.
2. Calibrate and record the correction factor for the Saybolt Furol Viscometries using the procedure found in Section 9-10 of AASHTO T72 Test Method. Refer to Appendix A2.1 of AASHTO T72 for the appropriate Standards.

Virginia Calibration Method – 15

Viscometer				Tolerances
Saybolt Viscometer				Must conform to T72 Figure 1 and APDX. A1.1 & A1.2
Saybolt Viscometer Calibration				Use Procedures found in Section 9 and 10 of T72
Standard				Use Table A2.1 of T72
Temperature				
Standards Vicosity				Min. efflux time = 200 and 600S
Viscosity Measured	T U B E			
Correction Factor	T U B E			Viscometer with Correction Factors greater than 1.0% shall not be used in referee testing
*Draw Diagram of Viscometer Tubes: *Designating Tube # with its calculated Calibration Date and Post Diagram in this book and by Viscometer				
Withdraw Tube				Figure 2 of T72 or other suitable device
Thermometer Support				Figure 3 of T72 or other suitable device
Filter Funnel				Figure 4 of T72 or other suitable device
Receiving Flask				Must conform to Dim. found in Figure 5 of T72
Name of Inspector:				
Date of Inspection:				
Date of Next Inspection:			Date of Last Inspection:	

Virginia Calibration Method - 16

Equipment Checked: **Pycnometers**

Purpose:

This method provides instructions for calibrating the volume contained by pycnometers at 68º F (Soils Laboratory), 73.4º F (Asphalt Laboratory), when used in materials testing.

Inspection Equipment Required:

1. 68º F Water Bath (Soils Laboratory)
   73.4º F Water Bath (Asphalt Laboratory)
2. Thermometer readable to + 3º F @ 68º F (Soils Laboratory)
   Thermometer readable to + 3º F @ 73.4º F (Asphalt Laboratory)
3. Balance readable to + 0.001 g

Tolerance:

Pycnometers shall be calibrated to the required precision of the test for which they shall be used. AASHTO T 100.5 may be used for further information. (Soils Laboratory)

Pycnometers shall be calibrated to the required precision of the test for which they shall be used. AASHTO T 84-95 may be used for further information. (Asphalt Laboratory)

Procedure:

1. Clean, dry, weigh and record mass of pycnometer.
2. Fill pycnometer to calibration mark with distilled water and de-air contents. Add water as necessary to bring contents to the calibration mark through out the de-airing process.
3. Place the pycnometer and contents in a 68º F (Soils Laboratory) 73.4º F (Asphalt Laboratory) water bath.
4. Add or remove water as needed to bring the contents to the calibration mark.
5. Check temperature of contents. If not 68 + 1ºF (Soils Laboratory), 73.4 + 3ºF (Asphalt Laboratory) leave in the bath until this temperature is obtained. When 68º F (Soils Laboratory) 73.4º F (Asphalt Laboratory)is obtained, remove the pycnometer and contents from the bath, dry off the outside of pycnometer and dry the inside of the stem to the calibration mark. Weigh the pycnometer and contents to the nearest 0.001 g and record the mass.
6. Record the calibration factors.

   Absolute Dry Weight of the Pycnometer at Room Temperature
   Weight of Distilled, De-aired Water at 68º F (Soils Laboratory)
   73.4º F (Asphalt Laboratory)

Virginia Calibration Method - 17

Equipment Checked: **Tag Open Cup Apparatus**

Purpose:

This method provides instructions for checking the equipment used to perform the Flack Point with tag open cup.

Inspection Equipment Required:

1. Ruler readable to 1mm
2. A calibrated thermometer graduated in 1°C increments having a rough which includes the temperature change to be checked.

Procedure:

1. Check copper bath, so as to maintain liquid level in both 3.2 mm below ridge of glass cup.
2. Glass test cup free of defects
3. Filling level gauge of suitable metal at least 3.2 mm thick, two projections, 3.18 ± 0.25 mm. Check T79 for additional measurements.
4. Ignition tapes, tips approximately 1.6 mm in diameter.
5. Draft shield-metal 610 by 710 mm fastened by hinges on the 710 mm side top triangular 610 by 610 by 86 mm.

Virginia Calibration Method - 18

Equipment Checked: **Cleveland Open-Cup**

Purpose:

This method provides instructions for checking the equipment used to perform the flask and fire paint by Cleveland open-cup.

Inspection Equipment Required:

1. Ruler, readable to 0.1 mm

Procedure:

1. Test cup, heating plate, test flow applicator, heater and supports conforming to ASTM D92, Cleveland Cup Apparatus, as shown in figures 1, 2, and 3.
2. Shield 460 mm square and 610 mm high, with open front.

Virginia Calibration Method - 19

Equipment Checked: **Hydrometers - 152 H**

Purpose:

This method provides instructions for checking the critical dimensions of hydrometers and calculating the composite correction factor for use in Particle Size Analysis of Soils.

Inspection Equipment Required:

1. Constant Temperature Water Bath (68º F)
2. Thermometer readable to + 1 deg. F @ 68º F
3. 1000 ml Sedimentation Cylinder
4. Hydrometer Size Template (w/2 holes, one at each bulb dimension extreme) or Calipers readable to + 0.01 cm

Tolerance:

Hydrometers shall meet the dimensional requirements of AASHTO T 88 Fig. 4. Refer to T 88 2.1.3 and 7.1-7.3 for further information.

Procedure:

1. Use the size template to check to see that the bulb of the hydrometer passes through the large hole and does not pass the small hole. Or use the caliper to measure the bulb dimensions to ensure that the meet the requirements of T 88 Fig. 4.
2. Prepare 1000 ml of liquid composed or distilled water and sodium metaphosphate in the same proportions that will be used in the hydrometer test. Pour the liquid into a sedimentation cylinder and place the cylinder in the constant temperature water bath. Allow the mixture to attain 68º F (measure the temperature with the thermometer until 68º + 1º F is obtained).
3. Insert the hydrometer into the liquid and allow the hydrometer to attain the temperature of the liquid. Read the hydrometer to the top of the meniscus formed on the stem, this is the calibration reading.
4. Determine the correction factor to be used during hydrometer tests (the difference between zero (0) and the calibration reading).

Virginia Calibration Method - 20

Equipment Checked: **Mechanical Shakers**

Purpose:

This method provides instructions for calibrating the sieving effectiveness of mechanical shakers used for size analysis of materials.

Inspection Equipment Required:

1. Balance readable to 0.01 g
2. Set of Sieves representative of sieves used during testing
3. Material sample of approximately the same type and size as normal samples and which does not appreciably degradate under sieving

Tolerance:

The mechanical shakers shall meet the requirements of AASHTO T 27 5.3 & 7.4 for aggregate, AASHTO T 88 6.2 for soils and the requirements listed below.

Procedure:

1. Check condition of shaker to ensure that it is in proper working condition with vertical or lateral and vertical motions which cause the particles to bounce and turn as to present different orientations to the sieving surface, and that sieves are held firmly during sieving operation.
2. Weigh the material sample and introduce the sample to the top sieve and set sieve timer to desired time. Operate shaker.
3. Weigh the contents of sieve, hand shake the material on the same size sieve for one minute and reweigh amount retained. Repeat for each sieve.
4. Determine the weight of material which passed each sieve during hand sieving and calculate the percent of the total sample which passed each sieve during hand sieving.
5. If not more than 0.5 percent of the total sample passed any sieve during hand sieving, the time of sieving is adequate. The sieving time may be reduced and the above procedure repeated until more than 0.5 percent of the total weight passes a sieve during hand sieving. At this point, the next shortest sieving time which did not have more than 0.5 percent passing a sieve may be used for routine sieve analysis.
6. If more than 0.5 percent of the total sample passes any sieve during hand sieving, increase sieving time and repeat steps 2-4 until no more than 0.5 percent passes any sieve. At this point, the time which resulted in no more than 0.5 percent passing may be used for routine sieve analysis.

Virginia Calibration Method - 21

Equipment Checked: **Softening Point (Ring and Ball)**

Purpose:

This method provides instructions for checking the equipment used to perform the softening point of asphalt in ethylene glycol.

Inspection Equipment Required:

1. Balance, readable to 0.1 g.
2. Ruler, readable to 0.1 mm

Procedure:

1. Check ring confirming to dimensions shown in Figure 1, AASHTO T53.
2. Balls – steel, 9.5 mm in diameter, weighing 3.50 ± 0.05 grams.
3. Ball Centering Guide: Confirming to Figure 1, AASHTO T53.
4. Bath – 800 ml low – firm Griffin broken of heat resistant glass.
5. Ring Holder – Confirming to Figure 1, AASHTO T53.
6. Ring supported, with bottom of rings 25.4 mm ± 0.8 mm above upper surface of bottom plate, distance of 12.7 mm and a maximum of 19.1 mm between lower surface of bottom plate and of bath.
7. Thermometer suspended so the bottom of bulb is level with the bottom of rings and within 12.7 mm of the rings, but not touching them.

Virginia Calibration Method - 22

Equipment Checked: Manual Hammer for Bituminous Mixes

Purpose:

This method provides instructions for checking the critical dimensions of compaction hammers.

Inspection Equipment Required:

1. Calipers readable to 0.001 inch.
2. Tape measure readable to 1/16 inch
3. Balance with a 5kg capacity, readable to 1g.

Tolerance:

Equipment shall meet the dimensional tolerances specified in the applicable test method (AASHTO T-245)

Procedure:

1. Use calipers to measure and record to the nearest 0.001 inch, the diameter of the hammer face determined by taking two readings 90° apart using the calipers.
2. Measure and record the distance of drop of the sliding weight to the nearest 0.01".
3. Disassemble, weigh and record the weight of the weight to the nearest 1.0 gram.

Virginia Calibration Method - 23

Equipment Checked: **Molds for Bituminous Mixes**

Purpose:

This procedure provides instructions for checking the critical dimensions of 4 in. molds used in asphalt testing.

Inspection Equipment Required:

1. Calipers, capable of measuring the height and inside diameter of the molds and readable to 0.001 inch.

Tolerance:

The inside diameter of the molds shall meet the dimensional tolerances specified in AASHTO T-245.

Procedure:

1. Measure and record the inside diameter of the mold to the nearest 0.001inch. Rotate the mold 90° (1/4 turn) and measure and record the inside diameter again.
2. Turn the mold over and repeat Step 1.
3. Check base plates and collars for proper fit.

Virginia Calibration Method - 24

Equipment Checked: **Auto Compactor for Bituminous Mixes**

Purpose:

This method provides instruction for calibrating the auto compactor used in preparing molds of asphalt mixtures for optimum asphalt content and maximum density comparable with the Hand Hammer.

Inspection Equipment Required:

Equipment as listed in AASHTO T-245.

Tolerance:

The auto compactor shall meet the requirements of AASHTO T-245 Section 2, Note 2.

Procedure:

1. Prepare at least 3 specimens of the same grading and asphalt. This can be done by batching individual samples or extracting field samples by quartering or splitting following AASHTO T 168-96, (ASTM D979-96).
2. Repeat step 1 using mechanical compactor, and adjust number of blows to give comparable results.

VIRGINIA CALIBRATION METHOD - 25

Equipment Checked: **Thermometer**

Purpose:

This method provides instructions for calibrating thermometers.

Inspection Equipment Required:

1. A Certified Thermometer for each temperature range to be used.
2. Controlled temperature fluid bath for each thermometer range to be calibrated.

Tolerance:

The temperature shall meet the tolerances specified in the applicable test method specified.

Procedure:

1. Using a Certified Thermometer, compare the temperature of Certified thermometer with the thermometer to be used for specific test.
2. Compare temperatures throughout the range used in specified test.
3. Record the difference between the Certified Thermometer and the test thermometer.
4. Apply correction factor (difference) if any during testing.

Virginia Calibration Method - 26

Equipment Checked: **Slump Cone**

Purpose:

This method provides instructions for verifying the critical dimensions and condition of slump cones for use in determining concrete consistency.

Inspection Equipment Required:

1. A ruler readable to 1/16" or a caliper with an 8" or larger maximum opening size.

Tolerance:

Slump cones shall meet the dimensional tolerances given in AASHTO T119. In addition, the cone shall be reasonably free of adhering concrete and other deformations. The shape of the cone shall be essentially circular and not elliptical.

Procedure:

1. Measure the top and bottom openings and the vertical height of the cone to the accuracy of the measuring device.
2. Inspect the cone for cleanliness, wear and shape.

Report:

1. The critical dimensions.
2. Condition of cone (i.e. clean and round).

Note:

Critical dimensions must be checked when the cone is first put into service and need not be checked unless there is indication of deformation.

Virginia Calibration Method - 27

Equipment Checked: **Conical Mold and Tamper**

Purpose:

This method provides instructions for verifying the critical dimensions of conical molds and tampers for determination of fine aggregate surface moisture.

Inspection Equipment Required:

1. A ruler readable to 1mm.

Tolerance:

	Mold	Tamper	
Inside Diameter			
Top	40 ±3 mm	Weight	340 ±15 g
Bottom	90 ±3 mm	Diameter	25 ±3 mm
Height	75 ±3 mm	(Face)	

Procedure:

1. Using the ruler, measure and record the inside diameter of the mold at two points rotated 90° apart, for both the top and bottom.
2. Using the ruler, measure and record the inside height of the mold vertically from a flat surface.
3. Visually inspect the molds for roundness, undamaged surface and rigidity.
4. Weigh the tamper and record the mass.
5. Inspect the surface of the tamper to ensure that it is circular and flat.

Report:

1. The critical dimensions.
2. Condition of mold (i.e. undamaged, rigid and round).

Note:

Critical dimensions must be checked when the cone is first put into service and need not be checked unless there is indication of deformation or wear.

Virginia Calibration Method - 28

Equipment Checked: **Single Use Molds**

Purpose:

This method provides instructions for verifying the critical dimensions and water tightness of single use molds.

Inspection Equipment Required:

1. A ruler readable to 1 mm
2. Inside dial caliper readable to ± 0.25 mm
3. 16 mm hemispherically rounded tamping rod (for testing 150 mm diameter molds).
4. 9 mm hemispherically rounded tamping rod (for testing 100 mm diameter molds).
5. #57 coarse aggregate (approx. 10,000 g).

Tolerance:

Single use molds shall meet the dimensional tolerances given in AASHTO M205. In addition, the mold shall be water tight and reasonably free of other deformations. The shape of the mold shall be essentially circular and not elliptical.

Procedure:

1. Using the caliper, measure and record the inside diameter of at least 3 molds at two points rotated 90° apart. Take care not to force the mold out of "round" while measuring.
2. Using the ruler, measure and record the inside height of the mold at two points rotated 90° apart.
3. Visually inspect the molds for perpendicularity and a flat bottom.
4. Fill 3 molds with #57 aggregate in three layers, rodding each layer 25 times with the tamping rod.
5. After rodding the final layer, empty the aggregate, wipe lightly with a damp cloth and examine the mold for physical damage.
6. Fill the molds with water and set aside. Check 30 minutes later for signs of water leaking.

Report:

1. The critical dimensions.
2. Condition of mold (i.e. water tight, perpendicular and round).

Note:

Critical dimensions must be checked when the cone is first put into service and need not be checked unless there is indication of deformation.

Virginia Calibration Method - 29

Equipment Checked: **Distillation of Cut-Back Asphaltic Products AASHTO T78**

Purpose:

This method provides instructions for checking the equipment used in AASHTO T78 Test Method.

Inspection Equipment Required:

1. Metric ruler readable to 0.1 mm

Frequency:

12 Months

Tolerance:

The equipment shall meet the requirement and dimensions described in AASHTO T78 Test Method.

Procedure:

1. Measure and record the dimensions and requirements described in Section 5 of AASHTO T78 Test Method.
2. Record results on Form F.

Virginia Calibration Method- 30

Equipment Checked: **Type A Meter (Protex Meter)**

Purpose:

This procedure provides instruction for checking the accuracy of the air meter.

Calibration:

1. The equipment needed to run the calibration is the Protex Meter- top and bottom- and a 5% calibration cylinder.
2. These are the four valves on the top we will be talking about. The fill valve, bleed or drain valve, vent valve and air inlet or pump valve.
3. When the handle is "in line" the valve is open. All of the valves in this picture are closed.
4. Before calibration, the .00708 cu. m^3 container and all contact surfaces should be clean.
5. The container should be placed on a reasonably level, solid surface. The 5% calibration cylinder is then placed, with the open end down, in the container and the container is then filled with water.
6. The top is then securely clamped, alternate sides simultaneously. Care should be taken to see that all contact surfaces are clean and moist.
7. The bleed, fill and vent valve should be open. The air pump valve should be closed.
8. Add water through the fill tube until it comes out the bleed valve in a steady stream. Tilt the meter slightly to get all the air bubbles out. Then close the bleed valve.
9. Water is then added until it passes the "0" mark on the calibrated tube. The fill valve is then closed and the vent valve is still open. Then open the bleed valve and let water run out until the water level in the calibrated tube reaches the "0" mark.
10. Now the vent valve is closed, and the air pump is opened.
11. Apply some air pressure to the calibration vessel. Incline gauge to approximately 30 degrees, roll while tapping cover and bucket to remove trapped air.
12. Apply air pressure until the reading on the calibrated tube is 5%, which is the volume displaced by the calibration cylinder. Tap gauge lightly to make sure the needle isn't stuck and take reading.
13. Release the pressure by opening the air vent valve and add water, if necessary, to restore the water column to the "0" mark.

Virginia Calibration Method - 31

Equipment Checked: **Type B Air Meter (Forney Meter)**

Purpose:

This procedure provides instructions for clocking the accuracy of the air meter.

Calibration:

1. The equipment you need to run the calibration is the Forney Air Meter -top and bottom- syringe, straight tube, a curved tube and a 5% calibrated vessel.
2. Put the base of the meter on a level surface and fill it with water. Make sure the cover is clean and damp. Then screw the short piece tubing into the petcock hole underneath the cover. Only one hole is threaded. Put the lid on and clamp it, opposite sides together.
3. With both petcocks open, take the syringe and inject water into the petcock that has the tube underneath, until a steady stream of water comes out the other petcock.
4. Pump until gauge reads slightly beyond pre-established initial pressure line (generally 3%). This is recorded on the gauge by the Materials Division. Wait a few seconds. If necessary pump or bleed-off air to adjust gauge hand to initial pressure line.
5. Close petcocks. Press needle valve lever to release air into base. Wait a few seconds until gauge hand line was correct.
6. Screw the curved tube into the petcock with the short tubing. Open the petcock with the curved tube. Press needle valve lever and fill calibrating vessel – you may also want to use the petcock at the bottom of the curved tube to control the flow -- this will take some practice. Close both petcocks.
7. Open opposite petcock first, and then the petcock with the curved tube to allow the water in the curved tube to run back into the base. Base now contains 5% air.
8. Pump up air pressure beyond initial pressure line. Use bleeder valve and bleed back to initial pressure line. Tap gauge lightly to stabilize. Close petcocks. Press needle valve lever. Wait a few seconds for needle to stabilize. Press lever again to release any remaining air. Tap gauge lightly. Gauge should now read 5%.
9. If two or more tests shows the gauge reading incorrectly at 5% air in excess of .1%, adjust initial pressure line to realign volume reading.
10. When gauge hand reads correctly at 5%, additional water may be withdrawn in the same manner to check results at 10%, 15%, 20%, etc.

Virginia Calibration Method - 32

Equipment Checked: **Sieves for Sulfate Soundness**

Purpose:

This method provides instructors for checking the sieve opening and spacing for sulfate soundness containers.

Inspection Equipment Required:

1. Calibrated glass beads for fine sieves (35-80 µm)
2. Calibrated glass beads for coarse fine sieves (15-35 µm)
3. Drill bits

Tolerance:

Openings must be smaller than that specified in M-92 for each particle size material. Container openings may be circular opening instead of sieve openings, according to Note 1 of AASHTO T-104. These sulfate soundness cans must provide openings to allow flow to and from the can. Openings must be 3 mm so not to allow a 4.75 mm material from passing through opening.

Procedure:

Sieves

1. Use appropriate size beads for each sieve.
2. Calibrate sieves in two parts. The coarse sieve (15-35 µm) and the fine sieve (35-80 µm) by hand shaking beads for one minute of continuous shaking.
3. Determine percent passing from glass beads.
4. Use charts supplied by calibration beads manufacturing to determine opening size.

Cans

1. Using 3 mm of a drill bit to randomly check two or three size openings on cans.
2. Visually inspect remaining openings to verify approximate diameters.

Note:

Critical dimensions not subject to abrasion ust be checked when the sieves/cans are first put in service and need not be checked unless there is reason to suspect changes.

Virginia Calibration Method - 33

Equipment Checked: **Straightedges (T99 & T180)**

Purpose:

This method provides instructions for checking the physical condition and straightness of steel straightedges.

Inspection Equipment Required:

1. Plate glass at least 12 inches square,
2. Shim or thickness gauge of 0.01 inches.

Tolerance:

Plane within 0.01 inches per 10 inches.

Procedure:

1. Hold the beveled edge of the straightedge on the plate glass. Check planeness by attempting to slide the shim or thickness gauge between the straightedge and the glass.
2. Rotate the straightedge 90° with relation to the glass and repeat step No. 1 above.
3. If similar results are not obtained for both trials, recheck using another piece of glass.

Virginia Calibration Method - 34

Equipment Checked: **Weighted Foot Assembly**

Purpose:

This method provides instructors for calibrating the Weighted Foot Assembly used on the Sand Equivalent Shaker.

Inspection Equipment Required:

1. Balance readable to 0.1 grams
2. Ruler or Tape measure readable to 1/16 inch.

Tolerance:

The equipment shall meet the tolerances specified in Test Method T176.

Procedure:

1. Weigh mounted Foot Assembly to 1000 ± 5 grams.
2. Measure and record the distance and diameter of rod to the nearest 1/4 of an inch.

Virginia Calibration Method - 35

Equipment Checked: **Grooving Tool**

Purpose:

This method provides instructions for calibrating the grooving tool.

Inspection Equipment Required:

1. Lupe readable to .1 mm
2. Caliper readable to .02 mm

Tolerance:

The equipment shall meet the tolerances specified in test method T89-93.

Procedure:

1. Measure thickness of curved end to 10.0 mm $\pm$ 0.1 mm.
2. Measure cutting edge of curved end to 2.0 mm $\pm$ 0.1 mm.
3. Measure width of curved end to 13.5 mm $\pm$ 0.1 mm.
4. Measure depth of gage to 10.0 mm $\pm$ 0.2 mm.
5. Measure length of gage to 15.9 mm.

Virginia Calibration Method - 36

Equipment Checked: **Liquid Limit Device**

Purpose:

This method provides instructions for calibrating the liquid limit device.

Inspection Equipment Required:

1. Caliper readable to 0.01 mm

Tolerance:

The equipment shall meet the tolerances specified in test method T89-93.

Procedure:

1. Measure thickness of cup to 2.0 mm ± 0.1 mm.
2. Measure depth of cup to 27 mm ± 1 mm.
3. Measure cup a cam follower to base to 47 mm ± 1.5 mm.
4. Measure thickness of based to 50 mm ± 5 mm.
5. Measure length of base to 150 mm ± 5 mm.
6. Measure width of base to 125 mm ± 5 mm.

Virginia Calibration Method - 37

Equipment Checked: **#325 Spray Nozzle**

Purpose:

To ensure a flow rate between 1500 and 3000 g/min. at 69 ± 3 KPa. (10 PSI ± 0.4 PSI)

Equipment Required:

1. Container with volume of 3000 or more grams
2. Pressure gauge
3. Scale
4. Stopwatch

Tolerance:

Inside diameter 17.5 mm
A central hole drilled in line with the longitudinal axis
An intermediate row of eight holes drilled 6 mm center to center at an angle of 5° from the longitudinal axis.
Outer row of eight holes drilled 11 mm center to center at an angle of 10° from the longitudinal axis.
All holes shall be 0.5 mm in diameter.
Flow rate shall be 1500 to 3000 g/min. at 69 ± 3 KPa. (10 PSI ± 0.4 PSI)

Procedure:

1. Record empty wt. of contained.
2. Adjust spray nozzle pressure to 69 ± 4 KPa. (10 PSI ± 0.5 PSI)
3. Put container under nozzle.
4. After one minute exactly, remove container with water from under nozzle, dry off any excess water on outside of container.
5. Record weight of container with water.
6. Subtract weight of empty container.
7. The difference will be the flow rate in grams per minute.
8. Make three determinations.
9. Report average of three determinations.

Example:

3082	3081	3079	(Weight of container with water)
726	726	726	(Weight of empty container)
2356	2355	2353	(Weight of water)

2356 + 2355 + 2353 = 7064

7064 ÷3 = 2355 (Average flow rate of spray nozzle in grams per minute)

Virginia Calibration Method - 38

Equipment Checked: **Satec Compression Machine**
Upper and Lower Bearing Blocks

Purpose:

This method provides instructions for checking steel bearing blocks to ensure the bearing faces do not depart from a plane by more than 0.001 in. in any 6 in.

Equipment Required:

1. Straight edge
2. 0.001 gauge sheeting

Upper and lower blocks dimensions.

Diameter of upper block - 6 3/8" (equipped with concentric circles)
Diameter of lower block - 9" (equipped with concentric cirles)

Procedure:

1. Place 0.001 gauge sheeting on surface of the upper bearing block, then place straight edge firmly against the 0.001 in. gauge sheeting and pull sheeting to see if it can be removed.
2. Perform this procedure again checking the outside edges of the block and move toward the center checking the entire surface of the block.
3. Repeat this procedure on the lower bearing block and if the 0.001 gauge sheeting can not be removed from between the block and the straight edge, the blocks are in compliance of 0.001 in any 6 in. as specified in AASHTO T22, Section 5.2.

Virginia Calibration Method - 39

Equipment Checked: **Freezer**

Purpose:

This method provides instructions for verifying the settings on Freezers.

Inspection Equipment Required:

1. A calibrated thermometer graduated in 2.0 F increments, having a range including the temperature being checked.
2. A brass thermometer well to retain temperature while the freezer door is open. This is essential for a constant temperature reading.
3. A clothes pin to hold the thermometer in such a manner as to enable the operator to read the scale easily from inside the freezer.

Tolerance:

Freezers shall be capable of maintaining a constant temperature range listed in the appropriate test methods.

Procedure:

1. Place the thermometer inside the brass well with the clothes pin attached to the thermometer. Position the thermometer on the shelf where the samples are normally placed.
2. Take the first reading at least 1 hour after closing the freezer.
3. Take as many readings as necessary to determine if the temperature range is within the specified tolerance. If the first reading agrees with the temperature setting and past readings, it will suffice.
4. Adjust the temperature of the freezer if an observed temperature reading is outside the tolerance specified (allow at least ½ hour for the temperature to stabilize between each adjustment).

Virginia Calibration Method - 40

Equipment Checked: **Rolling Thin Film Oven (AASHTO T240)**

Purpose:

This method provides instructions for checking the critical components of a Rolling Thin Film Oven.

Inspection Equipment Required:

1. Ruler, readable to 3 mm
2. Timer, readable to 0.1 sec.

Tolerance:

The equipment shall meet the tolerances specified in Test Methods T 240 and D 2872

Procedure:

1. Open the oven door. Measure and record the distance from the thermometer to the right side of the oven. Measure and record the distance from the thermometer bulb to the horizontal axis running through the center of the carriage.
2. Perform the test according to T240 and D 2872. After placing the test sample in the oven, record the time needed for the oven to recover to test temperature.
3. Record the number of carriage rotations in one minute.
4. Record the oven temperature at half-hour intervals until the test is complete.

Virginia Calibration Method – 41

Equipment Checked: **Molds, Top and Bottom Plates used in Gyratory Compactor for Bituminous Mixes**

Purpose:

This procedure provides instructions for checking the critical dimensions of 6 in. molds, top and bottom plates used in asphalt testing.

Inspection Equipment Required:

1. Tape measure, capable of measuring the height of the mold readable to 1 mm (.1 in.).
2. Calipers, capable of measuring the mold's steel wall, and diameter of top and bottom plates readable to .01 mm (.001 in.).
3. Digital Bore Gauge, capable of measuring the inside diameter of the molds readable to .01 mm (.0001 in.).
4. Two gauge blocks used to measure the diameter of the mold at various heights. One gauge block shall be 2.0 in. ± .1 in. and one gauge block at 4 in. ± .1 in.

Tolerance:

The mold height, wall thickness, inside diameter, and top and bottom plates shall meet the dimensional tolerances specified in AASHTO T-312.

Procedure:

Top and Bottom Plates

1. Measure and record the diameter of the top plate to the nearest .01 mm (.001 in.).
   Rotate the top plate 90° (1/4 turn), measure and record the inside diameter again.
2. Average the two readings and report the average on the calibration report.
3. Measure and record the diameter of the bottom plate to the nearest .01 mm (.001 in.).
   Rotate the bottom plate 90° (1/4 turn), measure and record the inside diameter again.
4. Average the two readings and report the average on the calibration report.

Molds

1. Measure and record the height of the mold to the nearest .01 mm (.001 in.).
   Rotate the mold 90° (1/4 turn), measure and record the height again.
   Rotate the mold 90° (1/4 turn), measure and record the height again.
   Rotate the mold 90° (1/4 turn), measure and record the height again.
2. Average the four readings and report the average on the calibration report.
3. Measure and record the steel wall thickness of the mold to the nearest .01 mm (.001 in.).
   Rotate the mold 90° (1/4 turn), measure and record the steel wall thickness again.
   Rotate the mold 90° (1/4 turn), measure and record the steel wall thickness again.

Rotate the mold 90° (1/4 turn), measure and record the steel wall thickness again.

Virginia Calibration Method – 41
Cont'd

Molds – Cont'd

4. Average the four readings and report the average on the calibration report.
5. Measure and record the diameter of the mold to the nearest .01 mm (.001 in.) at the bottom of the mold.
   Rotate the mold 90° (1/4 turn), measure and record the diameter again.
   Rotate the mold 90° (1/4 turn), measure and record the diameter again.
6. Average the three readings and report the average on the calibration report.
7. Insert 2 in. gauge block into the mold and place bore gauge on top of block.
   Measure and record the diameter of the mold to the nearest .01 mm (.001 in.).
   Rotate the mold 90° (1/4 turn), measure and record the diameter again.
   Rotate the mold 90° (1/4 turn), measure and record the diameter again.
8. Average the three readings and report the average on the calibration report.
9. Insert 4 in. gauge block into the mold and place bore gauge on top of block.
   Measure and record the diameter of the mold to the nearest .01 mm (.001 in.).
   Rotate the mold 90° (1/4 turn), measure and record the diameter again.
   Rotate the mold 90° (1/4 turn), measure and record the diameter again.
10. Average the three readings and report the average on the calibration report.
11. If the diameter of the mold at any height fails, than the mold is rejected.

Virginia Calibration Method - 42

Equipment Checked: **Rotational Viscometer (AASHTO TP48), (ASTM D4402)**

Purpose:

This method provides instructions for checking the critical components of the Rotational Viscometer, use Reference Fluid.

Inspection Equipment Required:

Fluke Meter #52 Viscosity Oil Standard (Cannon 9727E35)

Frequency:

6 Months

Procedure:

1. Send Viscometer back to Brookfield every year for recalibration.
2. Verify temperature between controller temperature and Brookfield temperature with fluke meter to determine actual temperature.
3. Use viscosity oil standard of known viscosity at various temperatures.

Virginia Calibration Method - 43

Equipment Checked: **Breaking Head for Marshall**

Purpose:

This method provides instructions for checking the dimensions of the breaking head used in asphalt testing.

Inspection Equipment Required:

1. Calipers, capable of measuring the bevels on the inside corners of both segments and the proving ring adapter readable to 0.1 inch.
2. Metal disk with a diameter of 4 inches and calipers readable to 0.1 inch.

Tolerance:

The bevels, proving ring adapter and inside diameter of the breaking head shall meet the dimensional tolerances specified in AASHTO T-245.

Procedure:

1. Measure and record the 2 bevels on the inside corners of both the upper and lower segment of the breaking head to the nearest 0.1 inch.
2. Measure and record the proving ring adapter to the nearest 0.1 inch.
3. Place the metal disk in the lower portion of the breaking head.
   Place the upper segment on top.
   Measure the clearance between the two segments to the nearest 0.1 inch.
4. Visual inspection of breaking head and proving ring adapter for chips, cracks and splits.

Virginia Calibration Method – 44 CUL

Equipment Checked: **HOBO Water Temp Pro – Temperature Data Recorder/Logger**

Purpose:

This method provides instructions for verifying the accuracy of the submergible HOBO Water Temp PRO – Temperature Data Recorder/Logger.

Inspection Equipment Required:

1. Crushed ice and a little water in an insulated container
2. A refrigerator
3. Box Car Pro 4 Program (Computer Software)

Tolerance:

The actual temperature will be slightly above 0º C, though less than 0.1º C if the logger is working correctly.

Procedure:

1. Launch the logger using a logging interval of 15 seconds and let it stabilize for at least twenty minutes at room temperature.
2. While waiting for the logger to stabilize, put crushed ice and just a little water in an insulated container. Example: Lunch Cooler -6½"W x 9"L x 6"D minimum
3. When the logger is ready, quickly place it in the crushed ice water bath with the sensor end down, completely submerging the end of the logger into the slushy mixture.
4. Place the container and immersed logger in a refrigerator to minimize temperature gradients. Leave it in for at least 20 minutes to be sure the logger reaches equilibrium.
5. Remove the logger, readout (offload), and graph the data.
6. Using Box Car Pro's zoom feature, enlarge the end of your plot to check the logger's accuracy. The actual temperature will be slightly above 0º C, though less than 0.1º C if the logger is working correctly (and you did everything right).

Virginia Calibration Method – 45

Equipment Checked: **BBR Stainless Steel Confidence and Non-Compliant Beams**

Purpose:

This method provides instructions for verifying the measurements of the stainless steel confidence and non-compliant beams used in calibration and verification of the BBR as specified in AASHTO T313.

Inspection Equipment Required:

1. Digital caliper or calibrated ruler capable of measuring to the nearest 0.01mm.

Tolerance:

The beams shall meet the requirements of AASHTO T313 section 6.4 for dimensions.

Procedure:

1. Measure the width, length and thickness of each beam twice. Thickness and width must be reported to the nearest ±0.01mm for calculation. The length must be reported to the nearest 1.0mm for calculation.
2. Average the reported values to obtain the width, length, and thickness measurements.
3. Report the known elastic modulus from the manufacturer for the confidence beam.

Virginia Calibration Method – 46

Equipment Checked: **BBR Standard Masses**

Purpose:

This method provides instructions for verifying the weights of the standard masses used in calibration and verification of the BBR as specified in AASHTO T313.

Inspection Equipment Required:

1. Mass balance, capable of measuring to the nearest 0.1g.

Tolerance:

The masses shall meet the requirements of the AASHTO T313, section 6.5 for weight.

Procedure:

1. Weigh and record the weight of each individual mass to the nearest 0.1g.

Virginia Calibration Method – 47

Equipment Checked: **Dynamic Shear Rheometer**

Purpose:

This method provides instructions for verifying the temperature and torque for the Dynamic Shear Rheometer as specified in AASHTO T315.

Inspection Equipment Required:

1. Thermistor, NIST traceable as described in AASHTO T315, section 9.2.2.1
2. Fluke meter, NIST traceable, capable of measuring ohms to 3 figures
3. Reference Standard having certified viscosity values spanning the temperature range from 52.0°C to 76.0°C.

Tolerance:

Temperature and viscosity measurements must conform to the requirements of AASHTO T315.

Procedure:

Temperature Verification

1. Place the 25mm diameter specimen plates in the rheometer and preheat the rheometer to the desired test temperature

2. Lightly coat the surfaces of the thermistor with petroleum jelly.

3. Place the thermistor between the rheometer plates and close the gap such that full contact between the thermistor and plate surfaces is achieved.

4. Allow the rheometer to reach equilibrium for 10 mins.

5. Use the Fluke meter to take the reading in ohms from the thermistor and record the reading. Do not turn on the Fluke meter until the equilibrium time is reached, and do not leave the Fluke meter on any longer than required to obtain the ohm reading.

6. Record the converted temperature and enter into the rheometer if necessary.

Transducer Verification

1. Place the 25 mm diameter specimen plates in the rheometer and preheat the rheometer to the desired test temperature.

2. Place the appropriate amount of Certified Viscosity Standard on the lower plate.

3. Reduce the gap setting to 1.05 mm and trim the excess Standard.

4. Reduce the gap setting to the testing requirement of 1.00 m and allow the sample to equilibrate for 10 mins..

5. Preform testing as for a standard asphalt sample at the desired temperature.

6. Record the viscosity of the Standard.

7. If the recorded viscosity deviates from the certified values provided by the manufacturer by 5% or more, the results obtained from the rheometer are suspect and further investigation to eliminate the discrepancy is required.

Virginia Calibration Method – 48

Equipment Checked: **Pressure Aging Vessel**

Purpose:

This procedure provides instructions for verifying the temperature and pressure for the Pressure Aging Vessel as specified in AASHTO R28.

Equipment Required:

1. Pressure gauge, capable of measuring a pressure range up to 2.5 MPa with an accuracy of 0.01MPa
2. Thermocouple
3. Fluke meter, or digital thermometer, capable of measuring to 0.1ºC
4. Timer, capable of measuring to 1.0 sec.

Tolerance:

Temperature and pressure measurements shall conform to the requirements of AASHTO R28.

Procedure:

Temperature Verification

1. Remove the sample rack and preheat the PAV to 100°C.

2. Open the PAV chamber and insert the thermocouple, placing it in contact with the internal RTD.

3. Close the PAV and allow the chamber to reach equilibrium.

4. Record the temperature.

Transducer Verification

1. Attach the pressure gauge to the external gauge attachment on the vessel lid. The sample rack remains in the pressure chamber.

2. Preheat the PAV to 100ºC.

3. Engage the pressurization and allow to reach equilibrium pressure.

4. Record pressure reading and monitor the pressure throughout the 20-hour aging period.

5. Record the time required for bleeding down the pressure.

Virginia Calibration Method – 49

Equipment Checked: **Direct Tension Test**

Purpose:

This procedure provides instructions for verifying the temperature and displacement and force transducers for the Direct Tension Test apparatus as specified in AASHTO T314

Equipment Required:

1. Certified ASTM 62C 76mm partial immersion thermometer
2. Verification specimen

Tolerance:

Temperature, displacement and force measurements shall conform to the requirements of AASHTO T314

Procedure:

Temperature Verification

1. Cool the DTT fluid to - 18°C..
2. Immerse the certified thermometer into the bath fluid to the proper depth, placing it in the intimate contact with the RTD.
3. Allow the fluid to reach equilibrium.
4. Record the temperature.

Transducer Verification

1. Cool the DTT fluid to - 18°C.
2. Place the verification standard into the bath and allow the standard and bath to reach equilibrium temperature for a minimum of 10 min.

3. Place the verification standard into the testing position and prepare to test, according to the manufacturer’s testing procedure.

4. Repeat the test four times, and determine and record the average strain, applied load and modulus.

5. Compare these values to the Verification Test Certificate provided by the verification specimen manufacturer.

Virginia Calibration Method – 50

Equipment Checked: **Pine Gyratory Compactor AFGC 125X**

Purpose:

This procedure provides instructions for checking and calibrating the equipment used in AASHTO Test Method T312.

Equipment Required:

1. Calibrated Stop Watch
2. Calibrated Proving Ring
3. Calibrated Gage Blocks
4. Calibrated RAM Device

Tolerance:

Equipment should have the speed of gyration of 30 $\pm$ 0.5 rpm., the capability of measuring the consolidation pressure within $\pm$ 3%, capable of measuring height within $\pm$ 0.1mm. and an internal angle of $1.16^{o} \pm 0.02^{o}$.

Procedure:

1. Turn on Gyratory Compactor a minimum of 15 minutes before calibrating to allow proper warm up of compactor.

2. Room temperature should be 18^{o}C to 25^{o}C.

3. Press the ENTER and SELECT keys simultaneously to start up the Menu driven calibration routine.

4. The display then prompts the operator for a special code found in the front of the manual. Use the ARROW keys to select the proper code number and hit ENTER.

5. For the calibration data and date to be stored, the entire procedure must be completed.

6. Make sure compactor is thoroughly clean before starting calibration.

Calibrating Speed of Gyration

1. Select VERIFY from calibration menu and press START. Using a digital stopwatch, time 10 revolutions on the compactor. The time elapsed should be 20 $\pm$ 0.33 seconds. This is equivalent to 30.0 $\pm$ 0.5 rpm.

2. If the speed of gyration is not within specified parameters, consult the factory.

Calibrating Consolidation Pressure (Ram Force)

1. Prior to calibrating the Consolidation Pressure, the proving ring must be flexed to at least the maximum load that will be used during calibration by using the RAM and DOWN ARROW keys. A steel block 1/8 inch thick shall be placed between the proving ring and the ram foot to prevent damage to the wear surface of the foot. The proving ring must be centered under the ram and the compactor and ring should be at room temperature.

2. Select the CALIBRATE option from the ram force calibration menu.

3. The controls prompt the operator to load to a specific force (1500 through 18000 Newton). The operator applies the predetermined force by manually jogging the ram using the RAM and DOWN ARROW keys simultaneously, then presses ENTER when the correct force is reached on the proving ring. Note: The dial on the proving ring should be tapped to achieve an accurate reading.

4. The computer control system stores the required information and prompts for the next predetermined force, repeating until the full range of the machine has been calibrated.

5. The operator must verify the ram force calibration data prior to continuing the calibration procedure by selecting the VERIFY option on the ram force calibration menu.

6. The controls automatically load the ram to the predetermined forces and operator must verify that the force indicated on the proving ring corresponds to the force displayed on the control panel. If the load readings exceed $\pm$ 3%, recalibration is required.

Calibration of Ram Position

1. Select the CALIBRATE option from the Ram position calibration menu.

2. The control system prompts the technician to insert a series of precision gage blocks under the ram.

3. These blocks are then loaded throughout the full range of the ram force automatically. (10.0” to 3.0”).

4. The operator must verify the ram position calibration prior to continuing the calibration procedure. This is accomplished by selecting the VERIFY option on the ram position calibration menu. The controls automatically load the ram to a

predetermined force and operator must verify that the position indicated on the display corresponds to gage block height under the ram. If the measured height differs from the target by more than ± 0.004 inches then recalibration is required.

Calibration of Internal Angle

1. The internal angle is calibrated every 12 months by a Certified Contractor.

NOTE: A full calibration is performed every 12 months by a Certified Contractor and lab personnel performs a verification calibration every 6 months.

Virginia Calibration Method – 51

Equipment Checked: **Troxler Gyratory Compactor 4140**

Purpose:

This procedure provides instructions for verifying the calibration of the equipment used in AASHTO Test Method T312.

Equipment Required:

1. Calibrated Stop Watch
2. Calibrated Proving Ring
3. Calibrated Gage Blocks
4. Calibrated RAM device

Tolerance:

Equipment should have the speed of gyration of 30 $\pm$ 0.5 rpm., the capability of measuring the consolidation pressure within $\pm$ 3%, capable of measuring height within $\pm$ 0.1mm. and an internal angle of $1.16^{o} \pm 0.02^{o}$.

Procedure:

Follow the Calibration Procedures located in the Manufacturer's Troxler Model 4140 Gyratory Compactor Owners Manual: pgs. 3-1 thru 3-7 and 3-14 – 3-15

Virginia Calibration Method – 52

Equipment Checked: **Pine/Brovold Gyratory Compactor BGC-1**

Purpose:

This procedure provides instructions for verifying the calibration of the equipment used in AASHTO Test Method T312.

Equipment Required:

1. Calibrated Stop Watch
2. Calibrated Proving Ring
3. Calibrated Gage Blocks
4. Calibrated Rapid Angle Measurement device (RAM)

Tolerance:

Equipment should have the speed of gyration of 30 $\pm$ 0.5 rpm., the capability of measuring the consolidation pressure within $\pm$ 3%, capable of measuring height within $\pm$ 0.1mm. and an internal angle of $1.16^{o} \pm 0.02^{o}$.

Procedure:

Follow the Calibration Verifying Procedures located in the Manufacturer's Pine/Brovold Gyratory Compactor Owners Manual: Chapter 4 pgs. 1-27.

Virginia Calibration Method – 53

Equipment Checked: **Pine Gyratory Compactor AFG1A**

Purpose:

This procedure provides instructions for verifying the calibration of the equipment used in AASHTO Test Method T312.

Equipment Required:

1. Calibrated Stop Watch
2. Calibrated Proving Ring
3. Calibrated Gage Blocks
4. Calibrated Rapid Angle Measurement device (RAM)

Tolerance:

Equipment should have the speed of gyration of 30 $\pm$ 0.5 rpm., the capability of measuring the consolidation pressure within $\pm$ 3%, capable of measuring height within $\pm$ 0.1mm. and an internal angle of $1.16^{o} \pm 0.02^{o}$.

Procedure:

Follow the Calibration Verifying Procedures located in the Manufacturer's Pine Gyratory Compactor AFG1A Owners Manual: Chapter 3 pgs. 1-27.

Virginia Calibration Method – 54

Equipment Checked: **Certified Digital Calipers**

Purpose:

This procedure provides instructions for verifying the calibration of the Digital Calipers used for verifying measurements of the laboratory equipment.

Equipment Required:

1. Calibrated Gage Blocks

Tolerance:

Digital Calipers shall be within ± 0.002 of the Calibrated Gage Block measurement.

Procedure:

Using the Digital Calipers to be verified, measure the length(s) of the Calibrated Gage Block(s) including a measurement at least the longest length the Calipers will be used for calibration purposes in the laboratory. If the Digital Calipers cannot meet the tolerance, have them recalibrated.

Virginia Calibration Method – 55

Equipment Checked: **Caliper or Micrometer, hereafter referred to as "instrument"**

Purpose:

The purpose of this procedure is to provide a consistent method in which to calibrate or check the calibration of instruments on an annual or as needed basis.

Initial Conditions:

1. Ensure the instrument is clean prior to following this procedure.
2. Ensure the instrument standards[2] are kept clean and handled carefully.

Procedure:

This procedure addresses measuring one dimension and checking against the appropriate specification. If multiple dimensions are to be checked, follow steps 1 thru 6 as needed.

1. Record the date in the Instrument Calibration Log
2. Close the instrument and zero the reading (refer to the instrument manual for proper operation).
3. Carefully remove the standard from the storage container and measure the calibrated dimension.
4. Record the measurement result in the Calibration Log.
5. Compare the result against the specification.
6. If the result is within the specification, the instrument can be retained for routine use.
   If the result is outside the specification, recheck the standard and record the result.
   If the recheck value is still outside the specification, :

   A. Refer to the operations manual for troubleshooting guidelines.
   B. Repeat steps 3 – 6. Record results on new line of log with a note on recalibration in the comments column.
   C. If the result is still out of specification,

      1. Place a sign on the instrument reading:
         "DO NOT USE INSTRUMENT - CALIBRATION PROBLEMS"
      2. Notify supervision immediately.
      3. Record "INSTRUMENT OUT OF SERVICE" in the log.

Notes:

1. For purposes of this procedure, the term calibrate may refer to a true calibration using a traceable reference or a check of calibration using a control standard.
2. Standard for instruments may refer to traceable gauge blocks or other suitable control standards.

Virginia Calibration Method - 56

Equipment Checked: **Ductility Measurement Scale AASHTO T51**

Purpose:

This method provides instructions for checking the measurement scale used in AASHTO T51 Test Method.

Inspection Equipment Required:

1. Calibrated Measurement Device

Frequency:

12 Months

Tolerance:

The equipment shall meet the requirement and dimensions described in AASHTO T51 Test Method.

Procedure:

1. Using a Certified NIST Traceable length measuring device, measure the distance of the measurement scale on the Ductility apparatus 10 centimeters at a time and record the measurement.
2. Continue measurements until the full length of the ductility device's measurement scale has been verified.
3. If any measurement of the ductility device's measurement scale does not correlate with the calibrated measuring device, adjust the ductility measurement scale so that it correlates.

Virginia Calibration Method – 57

Equipment Checked: **Slotted, Split or Annular Metal Surcharge Weights**

Apparatus:

CBR Surcharge Weights – An annular metal weight with a center or slotted hole.
Calipers – A set of calibrated calipers, minimum 6″ in capacity. Capable of measuring to and to an accuracy of .0001″.
Scale – A set of calibrated scales, weighing to the nearest tenth of a pound.

Purpose:

The purpose of this procedure is to provide a consistent method in which to calibrate Surcharge Weights on an annual basis for use in performing the California Bearing Ratio (CBR) test procedure.

Initial Conditions:

1. Ensure that all items are free of debris prior to calibrating.

Procedure:

1. Record the date, identification number and person(s) performing the calibration on the equipment calibration check list.
2. Starting with the outside diameter, using the calipers, measure and record on the equipment check list the cross section of the weight.
3. Rotate the weight 120º (⅓ turn) measure and record on the equipment check list the cross section.
4. Rotate another 120º (⅓ turn) measure and record on the equipment check list.
5. Take an average of the 3 readings and record on the equipment check list.
6. Measure the center hole and record on the equipment check list.
7. Compare results against AASHTO T-193, Figure 1, Table of Measurements for tolerances.
8. If results are within specifications retain results as permanent file, if out of tolerance go to step 9.
9. Recheck the measurements and if results are outside specification, go to step 10.
10. If recheck values are still outside specifications, discard the piece of equipment and remove that item from the calibration list by noting it as “out of specification and removed from service”.
11. Weigh the mass of each surcharge weight.
12. Record the mass results on the equipment check list and refer to AASHTO T-193, Figure 1, (Note 2), Table of Measurements for tolerances.

13. Compare results against the specifications.
14. If results are within specifications retain results as permanent file, if out of tolerance go to step 7.

Virginia Calibration Method – 58

Equipment Checked: **Penetration Piston**

Apparatus:

Penetration Piston – A metal piston of circular cross-section.

Calipers – A set of calibrated calipers, minimum 6″ in capacity. Capable of measuring to and accuracy of .0001″.

Purpose:

The purpose of this procedure is to provide a consistent method in which to calibrate a penetration piston on an annual basis for use in performing the California Bearing Ratio (CBR) test procedure.

Initial Conditions:

1. Ensure that all items are free of debris prior to calibrating.

Procedure:

1. Record the date, identification number and person(s) performing the calibration on the equipment calibration check list.
2. With the calipers measure the length of the penetration piston and record on the equipment check list.
3. Measure and record the diameter on the equipment check list
4. Compare results to AASHTO T-193 for measurement tolerances in Figure 1, Table of Measurements.
5. If results are within specifications retain results as permanent file, if out of tolerance go to step 6.
6. Recheck the spacer disk results and if results are outside specification, go to step 7.
7. If recheck values are still outside specifications, discard the piece of equipment and remove that item from the calibration list by noting it as “out of specification, removed from service”.

Virginia Calibration Method – 59

Equipment Checked: **Spacer Disks**

Apparatus:

Spacer Disks – A circular spacer disk made of metal.
Calipers – A set of calibrated calipers, minimum 6″ in capacity. Capable of measuring to an accuracy of .0001″.

Purpose:

The purpose of this procedure is to provide a consistent method in which to calibrate Spacer Disks on an annual basis for use in performing the California Bearing Ratio (CBR) test procedure.

Initial Conditions:

1. Ensure that all items are free of debris prior to calibrating.

Procedure:

1. Record the date, identification number and person(s) performing the calibration on the equipment calibration check list.
2. Starting with the outside diameter, using the calipers, establish a starting point measure and record on the equipment check list the cross section of the weight.
3. Rotate the weight 120º (⅓ turn) measure and record on the equipment check list the cross section.
4. Rotate another 120º (⅓ turn) measure and record on the equipment check list.
5. Take an average of the 3 readings and record on the equipment check list.
6. To measure the height of the disk, establish a starting point and measure and record on the equipment check list the height of the disk.
7. Rotate 120º (⅓ turn) measure and record on the equipment check list
8. Rotate another 120º (⅓ turn) measure and record on the equipment check list
9. Take an average of the 3 readings and record on the equipment check list.
10. Using the average of the readings compare results to AASHTO T-193 for measurement tolerances in Figure 1, Table of Measurements.
11. If results are within specifications retain results as permanent file, if out of tolerance go to step 12.
12. Recheck the spacer disk results and if results are outside specification, repeat the section(s) that is out of tolerance.
13. If recheck values are still outside specifications, discard the piece of equipment and remove that item from the calibration list by noting it as “out of specification, removed from service”.

Revised April 18, 2006

Virginia Calibration Method – 60

Equipment Checked: Air Permeability Calibration Check Procedure

Purpose: To Check Determinations between Regular Calibrations according to ASTM C204, Section 4, Note 8

Check determinations between regular calibrations with the standard cement sample is accomplished using CCRL proficiency samples submitted under the CCRL proficiency sample program as a check sample.

Once the sample has been obtained:

1) Prepare the sample in accordance with ASTM C204, Section 4.3, 4.4 and 45.
2) Run the air permeability according to Section 4.6
3) When the CCRL Final Report has been received, compare the results of the check sample with the CCRL final results to ensure the laboratory measured value is within two standard deviations of the final reported average value.
4) If the check sample is not within the acceptable range, then the equipment is recalibrated in accordance with ASTM C204, Section 204 using the current lot of NIST Standard Reference Material 114.